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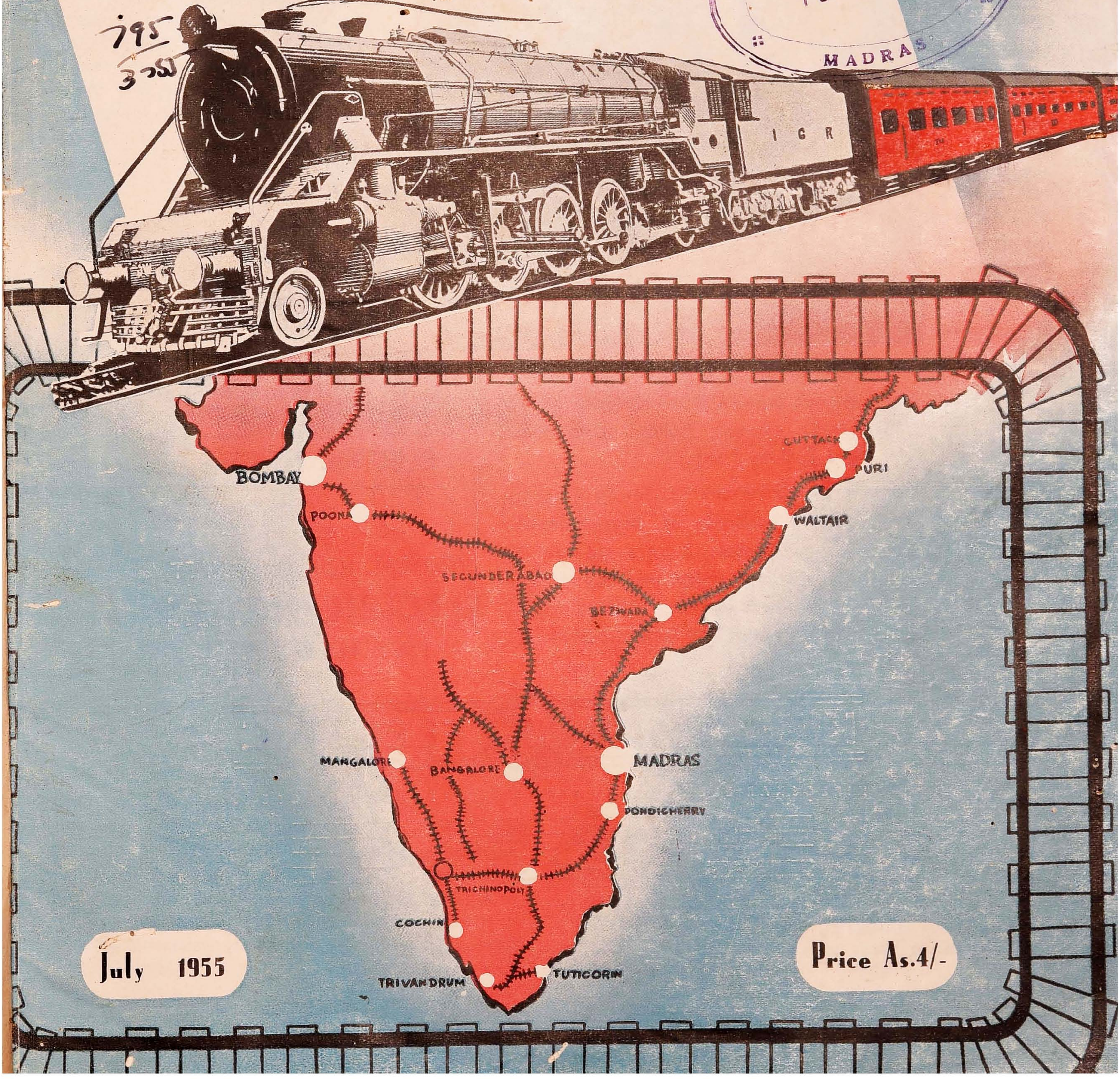

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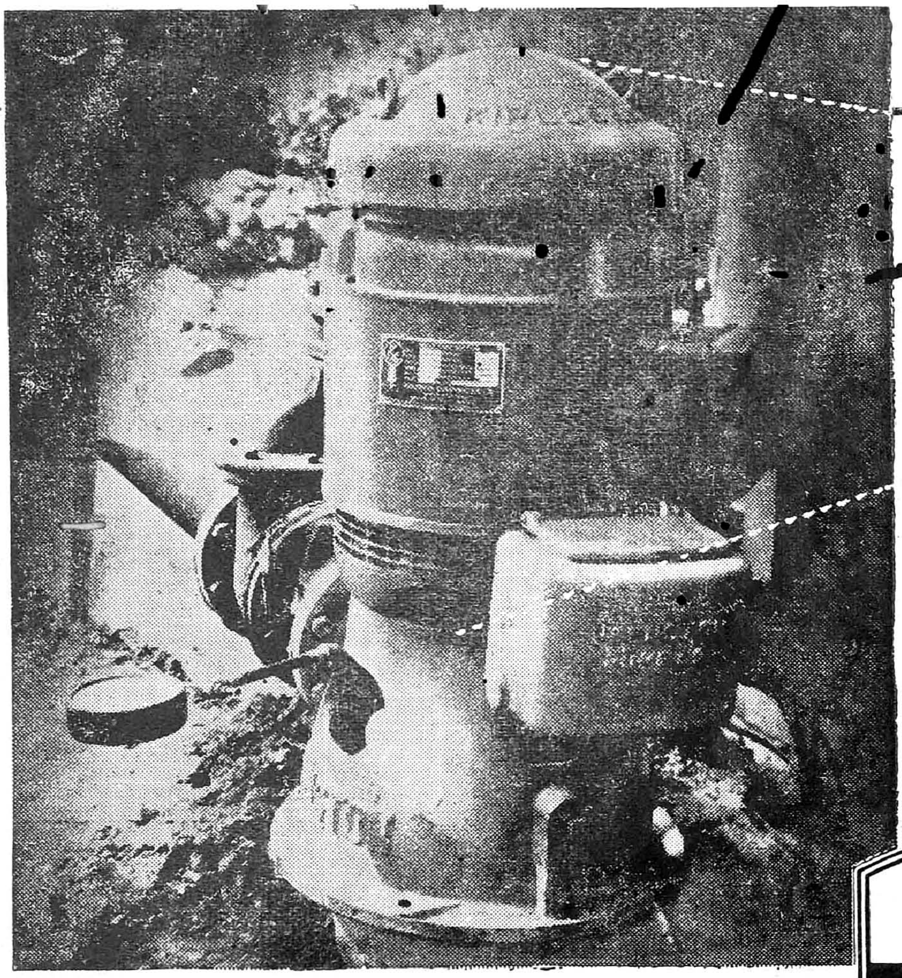

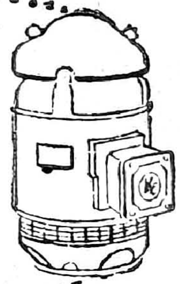

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PRESENT DAY MEDICAL NEEDS OF INDUSTRY

By Dr. Robert Collier Page, M.D., F.A.C.P.
Industrial Medical Consultant, 45, Rockefeller Plaza, New York 20.

THE BEGINNING

In the beginning it was always the same, whether it was the coal mines of Africa, the vast deserts of Arabia, the rubber fields of Indonesia, the fruit lands of Central America, or the oil and steel regions of South America. In some remote corner of the world a man would look up from his primitive scythe or hand-made fishing net or overloaded burro, and see some strangers. These new arrivals were carrying weird things of all shapes and sizes—tools, surveying instruments, maps—things the man had never seen before, and he would shake his head and wonder what it was all about.

Later that day when he reached his village, the word had already gotten around: a huge industry was coming to the region. Some natural resource—gold, or oil, or copper, or uranium, or any one of a score of others—lay burried beneath the soil which had been undisturbed for generations. Now the modern world which lay outside—far, far away from this remote region—needed the resource; an outside group, vast and wealthy and elaborately organized, was coming to extract the resource, process it, ship it away.

It was reported the new industry would need the services of hundreds, perhaps thousands, of people from the area. They would be trained to run giant new machines. They would be paid well, far more than their present bare subsistence livelihood. As the news spread, the people of the area became more and more excited, anxious—perhaps just a little frightened. In any case, one thing was certain: there would be some changes made.

FOREIGN COMPETITIVE INDUSTRY MOVES IN

And there were. Wherever industry moved in abroad, there were changes. There had to be. Because it is a perverse fact that gold, oil, copper, uranium, metals—the raison d'etre of overseas enterprise—exist only where you find them and have the room to process them. This usually means an unpopulated, non-industrialized area away from large centers of population. Most often, the area was naturally isolated by water or desert or looming mountains on every side, or trackless woods and jungles. There was no substantial local food supply, no roads, no buildings, no potable water—nothing. In the beginning, most often, there was just sun and air and the sky above, and a lot of bewildered local people wondering what was going to happen.

They didn't have long to wait. More strangers came—astride thunderous bulldozers now—and gouged out roads where only grass trails had been before. A complex industrial plant was built. Where there was no water, it was trucked in or piped in, or even transported across the sea. The land was flattened out and houses for employees erected, sewage systems laid down, huge supplies of food were stored in refrigerated warehouses. The strangers did not do this alone, by any means; thousands of nationals were employed from the surrounding regions at relatively high rates of pay which drew more and more to the area. In a short time, huge new population centers existed, separated by miles from any other community.

WHAT IT MEANS

It was this separation, this isolation of the new industrial community from any other that meant it had to be absolutely self-sufficient in solving its problems of living from day to day. Probably the most important of these problems is maintaining the health of all the employees involved in the industrial complex. To stay healthy is a basic drive of human beings, and, if for no other reason than to get its job done (and there are, of course, other reasons), industry, either abroad or at home, must do all in its power to maintain a healthy corps of employees. It's not an easy job, particularly overseas. It requires the ingenuity of many, the application of the accepted knowledge of the few, and the appreciation of its worth to employer and employee alike. (1)

EXPEDIENCY

In the early days of industrial activity abroad, the medical needs were all considered from the standpoint of expediency. There were two general areas of worry when management took up medical considerations, usually, incidentally, without the active participation of

a qualified physician or representative of the company's medical department.

The first worry was prevention of infection and tropical diseases. It was important at all costs, industrial leaders felt, to avoid such prolonged and devastating illnesses as typhoid fever, malaria, beriberi, yellow fever, and amoebic dysentery.

The second worry of industrial leaders in the relatively few times when medical considerations were on the agenda was to protect industry from unwarranted accident claims by having the facilities to render emergency medical care when accidents did happen.

These provisions—the fight against mass infection and the treatment of accident casualties—were the catalyzing agents in the early days for industry to set up medical facilities on the scene, staffed by competent doctors and nurses. Industry didn't stint—at great expense, immaculate hospitals and dispensaries were erected. Vast supplies of drugs were made available, and doctors and nurses were imported from America, England, and Holland.

The medical profession in the country where the industry was located, was usually ignored. In the first place, there were few local doctors in the immediate vicinity. Most of them lived and practiced in the larger cities of the country and would not come to the, hinterlands unless some special arrangements were made for them. And this much is clear: industry usually made no special arrangements to enlist the co-operation of the private medical profession in the country concerned. Apparently it was easier, at least looking on it now with the rather smug advantage of hindsight to handle the medical problem as a "package deal"; to bring in the company's doctors, nurses, and facilities without relying in the slightest on local participation.

LANGUAGE

Language difficulty, of course, added to this state of affairs. The foreigners, particularly the wives, made no real attempt to become fluent in the native tongue, and this group particularly, insisted on foreign doctors. The foreign doctor, on the other hand, had a great incentive to learn the language of the nation and did so promptly. He was thus able to care for both the foreign and the national groups.

At first it worked;—it worked fine. A quick look overseas will tell us that. In the practice of medicine as applied to industry abroad, we have conquered typhoid and yellow fever, malaria, dysentery, and, what is more, we have made great progress in disseminating the precautionary methods so that they are now common knowledge. Beriberi and other food deficiencies no longer cause us much concern.

In the field of accident prevention and casualty care, management can be justly proud too. If an accident happened, there was a doctor on hand. A mine worker in South Africa could slip in a coal chute and break his leg, and a doctor from England would direct the proper splint to be applied. It was expensive; it took trouble to get the trained men with modern equipment in the right place. But management realized that the prevention of accidents paid high dividends in workers' morale, efficiency and decrease in lost time.

Strong safety programs were put into effect, and the accident rate began its downward drop. As the years went by, almost every company operating abroad had a doctor, part-time or full-time, on the payroll. As techniques were standardized, precautionary methods developed, and workers trained in the limitations of equipment, the accident rate continued to fall.

Before long, the imported doctor, his nurses, and his elaborate company-financed facilities were not doing very much in the way of giving emergency treatment; the care of industrial accidents had decreased in certain instances to a vanishing point. As we have seen, parallel with this decline of activity, the contagious diseases of the area were being rapidly wiped out. (2) So, in a sense, the "primary" duties of the medical facility—control of disease and emergency accident care—were by no means exhausting the potential of the medical installations.

But it was so nice to have a "doc" around the house, to paraphrase the old song. The fact that a doctor was in the area gave management a sense of security—the feeling that no one could complain. So a medical program was formulated, vaguely, in an unplanned way; often the principles of the program were not even recorded on paper. Usually the medical policy, such as it was, reflected certain ideas of some of the people in management. Executive Jones thought that if complete medical care of the employee by the company was instituted, it would be a gracious gesture. Executive Brown thought it would be good public relations to extend complete medical care to the employee's family. Hernia and tuberculosis programs were started and so the extent of the medical program grew, really, it is fair to say, without any long-range plan in view.

Many medical programs were begun in an honest attempt by corporations to meet their responsibilities, without adequate knowledge or experience as to just how

to proceed. The intention was honorable, no question about it. And for a time—while the wives of Peruvian employees flocked to the hospitals to have their babies, while the African labourers lined up for their tisses, while industry abroad followed the policy of close medical supervision "from the cradle to the grave",—things looked just fine.

Health for all was the slogan! Overseas industry was to be an enclave of bright-eyed stalwart employees and their families, a medical utopia with appendectomies for the asking, pills by the gross, and unlimited water supply in every worker's home.

THE QUESTION OF COST

This went on for some time until one fine day, responsible management looked around and asked: "Just what kind of uncontrollable situation have we developed here?" They looked closer, then called for the aspirin, along with a good cost accountant. They initiated a fresh analysis of the medical situation of industry abroad and came up with this conclusion: that the so-called medical utopia had resulted in "trouble in heaven for both management and worker".

TROUBLE IN HEAVEN FOR BOTH MANAGEMENT AND WORKER

What had gone wrong? Well, first of all, there was the matter of costs which had zoomed far in excess of the cost rises in other industry operations. For example, in 1940, the total medical expenses for the Latin American affiliates of Jersey Standard was a little less than 3 million dollars. By 1953, this figure was well over 10,000,000 dollars, and in spite of subsequent curtailment, the operating expenditures are still going up. This is not an exceptional case; it is typical of the experience of overseas industries. From a monetary point of view, medical policies written in 1920 could be interpreted in hundreds of dollars or pounds. These same policies, without changing a single word in phraseology, must now be interpreted in thousands, and in some instancer, millions of dollars; and, particularly because unions (3) have now found the health field is a good bargaining ground, there appears to be no end in sight for these expenditures.

CURATIVE MEDICINE—THE WISH OF ALL

It is impossible, upon such an occasion as this, to provide a detailed breakdown of these expenditures. It is known, however, that the majority of this money is being spent for curative medicine. By curative medicine, I mean actual medical care for *all* illness after it develops, without primary regard for the circumstances which caused it. Most union demands in the health field are, in reality, webbed around the curative medicine concept; more hospitals, the labour bargainer will call for, and more surgical plans and dental plans and fuller family coverage in all respects. (4)

It is outside the province of this presentation to comment on the justification for these demands: what is more important is that the basic concept underlying these demands is wrong. The unions are not alone in this error: management, too, has tended to take the negative approach of curative medicine to meet medical needs. (5)

CORPORATION MEDICINE—A SHORTSIGHTED POLICY

This negative approach is signalized by the practicing of corporation medicine. In line with this thinking, health problems are solved merely with money. For money designs and builds hospitals. Money recruits more doctors to heal the already ill individual.

This practice was particularly in evidence in remote tropical or desert areas. The paternalistic viewpoint was in vogue, and corporation medicine was the only answer. As the cost of these programs rose and the companies began to feel the increased financial burden, they tried a different tack.

The companies encouraged the company doctor — who was on a salary basis — to build up a practice of non-company people and charge them for medical care. In one instance with which I am familiar, a hospital was built with the idea that about 75% of the patients would have no company connections and would be drawn from a large city where the private practice of medicine had been in existence for over 100 years. (6) It was hoped that the hospital charges would help defray the expenses incurred by the company's previous decision to enter corporation medicine.

This was direct competition by a foreign organization with a well-established practice of private medicine conducted by nationals. One can imagine how they viewed this sideline activity of the large foreign corporation. It was bad enough that the national doctors had not been consulted when the medical program was formulated! Now they had to look on in dismay while tangent operations of an industrial organization went into competition with them.

For that matter, usually, the imported doctor employed by the industrial enterprise, had not been consulted either, at least early enough to have any influence on the planning. The company doctor in those days was

poorly paid. He was told what he should do, and if he did not like it, another doctor could be found who would follow orders. If there was such an entity as a medical department, its budget was a tiny fraction of the overall company expenditures and the value of the doctor in charge was considered in a similar proportion.

Many doctors who wished to voice their opinions and were not given a satisfactory hearing soon left the service of the industrial enterprise and began private practices of their own. Some were successful and added prestige to the foreign colony living abroad. However, the majority became at loggerheads with the local profession who often used government contacts to see to it that no foreigner could obtain a license to practice medicine within the country.*

So, in one way or another, relations with the local medical profession began to be strained. This was unfortunate because in many foreign countries, particularly in Latin America, the medical profession is held in very high esteem by the local population. For generations, sons of the very best families have studied medicine. Some of their medical schools date as far back as 1805 when the first medical department of a university was established in Venezuela. (7) In 1808, a medical school opened in Lima, Peru; this was only 23 years after the first medical school in the United States. In all of the capital cities — Lima, Quito, Santiago, Buenos Aires, Rio de Janeiro, Caracas, Cairo, Damascus, Beirut, Delhi, to mention a few,—eminent physicians on a par with those in New York or London can be found. Wherever there is a seat of medical learning, doctors skilled in the health and welfare needs of their own people are available. These learned professional men are, for the most part, proud, and have to be approached, with tact and understanding. I often wonder how many representatives of private enterprise operating abroad have consulted such men before embarking on a health program for their employees.

In certain countries, there are pitifully few trained physicians, it is true. The weak standing of the medical profession in these countries reflects the lack of interest by the controlling powers in medical affairs over the years.

It is safe to say that a weak national medical profession—weak in numbers, competence, facilities and prestige, weak in its ability to minister to the needs of the people.—is an important element of the national insecurity which almost always contributes to a radical demagogue rising to power. One more reason then why corporation medicine overseas, as we have discussed it has in many cases been a short-sighted policy, is that does not bolster the position of the local physician; rather, it usually cuts the ground right from under him.

We have now briefly examined the historical background behind the problem of meeting the medical needs of industry overseas; we have seen how most of the current systems developed in a most unprofessional manner, on the basis of little more than whim and impulse. We have seen how these systems, with tangents expanding in all directions, became corporation medicine, thereby antagonizing an important group within the national community; a group with a tremendous potential for encouraging stability and co-operation.

MEDICAL NEEDS OF EMPLOYEE VS FAMILY

The mounting costs of this corporate medicine might be palatable if, indeed, it were doing the job of meeting the medical needs of employee. But it is not. It is misdirected, and the employee's needs are side-tracked in a department of cross-purposed activity. Corporation hospitals are bulging with invalids — not with employees, however, but with their dependents — wives, children, aunts, uncles and grandparents. The beds formerly filled with malaria victims are now kept warmby the pregnant national. In Latin America, by commitments of all kinds, the company with which I am associated is responsible for, in a medical way, approximately 160,000 people. Only 41,000 are actual employees. This must mean that much of management's investment for medical services to employees is being shunted off course.

NOT A THRIVING COMMUNITY

The effect on the national employee was not altogether a happy one. Benefits came free and too fast. There came to be a complete dependence on the company to maintain full medical health for the employee and his family; the national, aided by his union, came to think this was the company's — not his — responsibility. Meanwhile, what had been an isolated camp site grew and developed into a large community. It could have been a thriving community with a broad base of activity — but it wasn't; it was simply an appendage that depended limply on the industrial organization to fill its every need. Through the years it had been established in the minds of local governments (8) and recipients, both foreign and national, that complete health service is not only one of their inalienable rights but also an obligation of the company.

NOW A POSITIVE APPROACH

There are indications that the situation is improving, however, and while I do not want to be over-enthusiastic

and report that tomorrow everything will be fine, I have no desire to be a gloom-spreader, either.

THE NATIONAL DOCTOR AND NURSE HAVE GAINED STATUS

First off, the concept of the doctor and his work in industry is changing. The national doctor has finally reached his place in the sun. Companies are now consulting with the local medical profession, asking for their co-operation, bolstering the national doctor in many practical, concrete ways.

The national nurse, (9), too, has not been ignored. She has been trained and given a position of dignity comparable to the important function the nurse fulfills at home.

In this respect, incidentally, the Creole Company in Venezuela has discovered that the institution of midwifery (10) has had a most constructive and beneficial effect.

With the trained midwife going into the home, not only is instruction given the mother about caring for the newborn, but, in addition, the nurse will know the health status of the other children and the sanitary conditions of the home. In short, she is the local public health nurse. By making available in the home her knowledge about how to prevent disease, the trained midwife can curtail many unnecessary visits to the company-financed hospital.

Probably the most important cause for hope is that the old concept of curative medicine is giving way before the advent of constructive medicine. Curative medicine is negative—it thinks of health in terms of sickness and death, drugs and hospitals, pain and worry.

CONSTRUCTIVE MEDICINE VS CURATIVE MEDICINE

Constructive medicine (11) thinks of health as mental and physical vigor, the ability to enjoy a useful and productive life with fellow associates. Constructive medicine utilizes every facility and judgment at a doctor's disposal so that he can detect disease early enough to do something simple and positive about it—at a price, the patient can afford. Constructive medicine means preplacement examinations and periodic health inventory examinations involving the *whole* man, psychological as well as physical factors, so that the man comes to understand his medical limitations and is better equipped to take care of himself. Not only that, but his days are more meaningful. Until recently, health work aimed at adding years to life; today, constructive medicine seeks to add life to years.

COMMUNITY HEALTH CENTERS

This modern concept of constructive medicine is reflected in the sound industrial medical program of today which represents and effort by the alert industry toward "getting out from under" corporate medicine. This is an intensely complicated job because, as many medical directors in the field have found out, it is impossible to "bargain out" with unions the many concessions that have already been "bargained in".

But a start has been made toward returning the responsibility of the profession to the profession by the, establishment of community health centers. The core of this contemplated program calls for a system of community medical centers of an entirely new type. Each unit of operation can be adjusted to local needs and be autonomous at community level. Each facility will house a balanced team of medical service personnel with local groups of private practitioners staffing each installation. (12).

A start, as I say, has been made toward this end, but it is still just a start. An arrangement modelled on this one made by the management of International Petroleum Company (13) with a Peruvian doctor might be offered as an example.

The Company built a "Medical Service Station" and fully equipped it. Peruvian doctor rented it on a long-term agreement with an option to buy. During the period while the doctor was building up a practice, he was kept on the company payroll as a consultant. The local medical director saw to it that enough work was sent to him to take care of his consultant fee. Any work done over and above this specified amount was paid for on a fee-for-service basis.

In Maracaibo, Venezuela, the Creole Company has turned over a brand new hospital to a private group which is operating it successfully. Furthermore, consideration is being given to the feasibility of several Croele's salaried physicians going on consultant status, thereby allowing them ample time to develop large consulting practices in their respective specialties. Maracaibo, it is worth mentioning, is a thriving city where approximately 180 doctors are in private practice.

CORPORATION MEDICINE VS MEDICINE AS A PRIVATE ENTITY

We have observed how a really sound industrial medical program is based on the principle of constructive health maintenance of the employee. When the principle is exceeded or ignored, management has accepted almost limitless commitments. When care more than of an emergency or diagnostic nature is given by a company medical department, it is corporation medicine, an attempt to run a medical business within the company. The employee cannot possibly receive as careful attention or the individual interest that he would from his private physician.

When a medical program includes non-employees, the company is taking on a tremendous burden, both financially and from a human relations point of view. It becomes an ever-increasing company burden because there is little possibility of ever reducing such a commitment when agreed upon across the bargaining table. When carried out in conjunction with an industrial health program for employees, there is likewise little return for effort expended, for the simple reason that non-employees numerically far exceed the worker, and soon the workers' program is reduced to little more than first-aid.

FUNCTIONAL CENTRALIZATION

In multiple plants, medical service must be standardized and centralized, or there will be no uniformity of action. There must be co-ordination within the company of employee plans and medical programs. If retirement plans or not precisely stated and cannot be administered easily, they spell danger for the company. Before any medical retirement plans or health insurance plans are considered seriously by the company, the actual medical service that can be provided should be investigated. Adequate medical facilities must be available to handle the additional workload.

COMPETITIVE ENTERPRISE A VOLUNTARY AGENCY IN THE HEALTH FIELD

Competitive enterprise operating abroad might well consider itself a voluntary agency before it provides health services. Company medical service of any and all types should be conceived at the onset as being a temporary measure which in time could grow into a community medical service in keeping with the total needs of the area in question (14). Unfortunately, in the past, this has not been the case. The provision of total health services has been assumed by local governments and recipients to be an obligation of the company. This may well have been reasonable at the time when such medical commitments could be considered in terms of thousands of dollars without appreciable concern on the part of the local practicing physician. Now, when these same commitments must be reckoned with in terms of millions of dollars of actual operating cost, to say nothing of capital investments, the strongly nationalistic medical profession and an aggressive labor movement, the problem of health and welfare service requires a much broader perspective. (15) Any successful change can only be accomplished through the utmost exercise of diplomacy and a flexible attitude. To this end the local medical profession, which has to render whatever services are given, along with the actual recipient of the health services, must feel *they* have played a major part in the establishment and organization of the services.

THE IMPORTANCE OF PARTICIPATION OF THE MEDICAL PROFESSION

The quality of medical services provided overseas by company commitment, and even the possibility of providing them, depends upon the mutual goodwill between the national medical profession and the management of private enterprise who, in the final analysis, has to pay the bill.

QUALITY AND QUANTITY

From the professional viewpoint, there will always be concern to preserve quality. Management will always be anxious to do its best by medical benefits for employees within the limitations of the industry's financial resources. Lack of active participation in the past on the part of the medical profession has fostered frequent contention between the profession and private industrial enterprise. The victim of such resentment is the employee.

What a shame this is!—particularly today when medical knowledge is being placed within the reach of the general public. Workers are becoming more closely acquainted with the actual science of health. (16, 17, 18, 19, 20). Daily they are being trained to become familiar with medical terms which assist them in the early detection of many medical ills. Medicine is no longer a mysterious, occult science. A progressive medical plan which involves active participation by *all* sectors of the community is consequently sure of receiving the active support of a knowledgeable and alert citizenry.

The management of competitive enterprise might consider these facts before adjusting its present health program abroad. And the need for adjustment is here. The time is now, because the "point of no return" has already appeared on the horizon.

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* No foreign doctor, with perhaps a rare exception, can obtain a license to practice medicine in any of Latin American countries.

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(Inserted in the interests of Travelling Public)

EAST AFRICAN RAILWAYS 59th CLASS

By A Special Technical Correspondent

IN 1892 a survey was carried out for a railway to be built between Mombasa and Lake Victoria to assist in the suppression of slave trading, but it was not until 1898 that the first section of the line from the coast to Voi was opened to the public and at that time there were 24 locomotives.

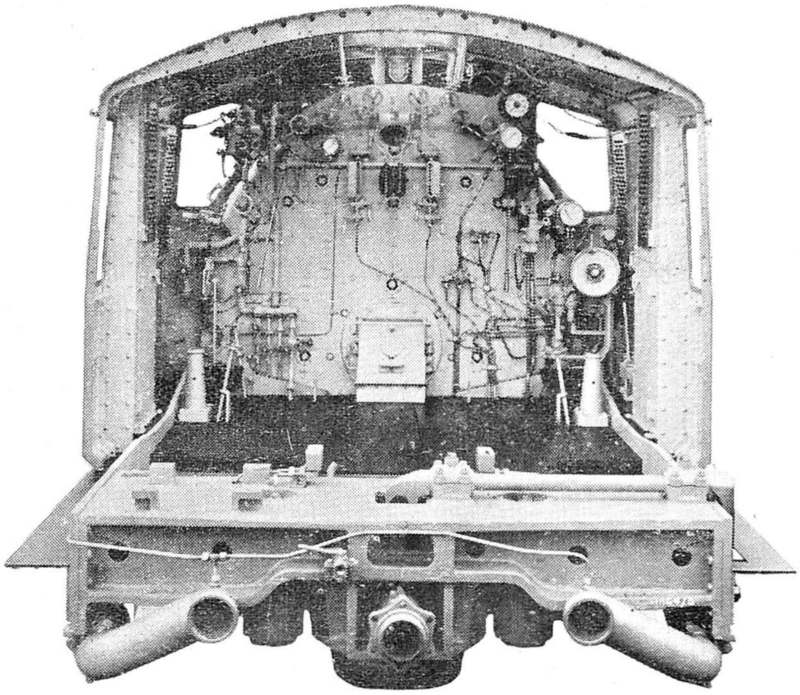
In 1901 the Uganda Railway as it was then called, was opened for traffic having reached Kisumu on Lake Victoria, 585 miles from Mombasa, and the gauge of the railway although originally planned to be 3′–6″ was actually built as metre gauge, partly as a result of a misunderstanding. The construction of the line due to the heavy terrain through which it traversed, had necessitated extensive earthworks, which were equivalent to a 4½ ft. embankment throughout the whole 585 miles.

In 1948 the Kenya and Uganda Railways and the Tanganyika Railways were amalgamated to form part of the East African Railways and Harbours Administration and today there is a total route mileage of 3,100 miles of metre gauge. The main line of the Kenya and Uganda section between Mombasa to Nakuru climbs to over 9,000 ft., Nairobi, the capital, being at an altitude of 5,600 ft., so it is not surprising that 541 miles of this line have gradients of 1 in 66 or steeper.

In 1926 the first Beyer-Garratts were introduced on the Railway with an axleload of 10 tons, and they immediately showed their suitability, so that by 1938, thirty-six locomotives of the Beyer-Garratt type were operating about two thirds of the main line traffic. During the war and after, further Garratts have been supplied to assist in moving the traffic, which greatly increased during the war and has continued to do so ever since, so that with the completion of the delivery of the 34 locomotives which comprise this present order, the railway will have 149 Beyer-Garratts in service.

The original line was laid with 50 lb. rail and today a considerable amount of the total route miles are still of this weight. On the main line improvements have been made to eliminate the momentum gradients and re-alignment of the track between Nakuru and Mombasa has been carried out. Extensive relaying of the line has also been undertaken with heavier rail of 80 lb. and 95 lb. sections. This coupled with investigations carried out on rail stresses has resulted in greatly increased axleloads being permitted on the main line.

This increase in axleload opened the way to the employment of even more powerful locomotives, and the 59th Class Beyer-Garratts are the first locomotives to be designed to meet these new conditions, they have a tractive effort of 83,350 lb. on a maximum axleload of 21 tons. They will operate on the 329 mile Mombasa—Nairobi section which carries the greatest density of traffic in East Africa and will be used for hauling loads of 1,200 tons over the 1 in 66 gradients; this load is a 71% increase over the present permitted maximum of 702 tons.



These Beyer-Garratt locomotives which are the most powerfull metre gauge locomotives in the world have been designed to the requirements of Mr. G. Gibson, the Chief Mechanical Engineer, East African Railways and built under the supervision and inspection of the Crown Agents for Oversea Governments and Administrations.

It is only when one sees the actual locomotives that one realises their massive size, no photograph really does them justice. The overall length is 104′–1½″ and the total weight in working order is 252 tons, which includes 8,600 gallens of water and 2,700 gallons of oil fuel.

THE BOILER UNIT

Ample steam production is ensured with the boiler which is 7′-6″ diameter and has a grate area of 72 sq.

ft. and the length between the tubeplates is 15 ft. The boiler is of all steel construction, the firebox is of the round top type with radial roof stays, the front three rows being flexible and the inner firebox is of Golvilles "Double Crown" brand plates, whilst the firebox stays are of "Dunic" steel. All the stays are riveted over on the fire side.

Although the fire hole door is of the usual type used on oil fired locomotive, the fire hole in the boiler back plate is large enough to accommodate a mechanical stoker, should the need arise to convert this class to coal burning, provision is also made for fitting five arch tubes if needed to support a brick arch.

The firebox back plate has plate gussets, which are also used for staying the smokebox tubeplate, this being of the drumhead type. Cross staying of the outer wrapper plate is provided above the inner firebox.

Dry steam is ensured by using a "Melesco" Steam Dryer in the dome and the superheater header in the smokebox combines a multi-valve regulator, the 50 superheater elements are $1\frac{1}{8}$" o. d. x 9 s. w. g. thick, all this equipment being supplied by the Superheater Co. Ltd.

The flue tubes are $5\frac{1}{2}$" outside diameter and the small tubes of 2″ diameter, all tubes being made of "Aquacidox" steel.

In the smokebox the chimney petticoat can be easily adjusted for height, while four "Goodfellow" tips are fitted to the blast pipe.

The flame pan is of ample size and is fitted with two burners which are accessible for servicing below the front of the firebox. The oil firing equipment is to the Railways' standards and incorporates a heating coil in the oil tank and a secondary heater alongside the foundation ring. A thermometer being provided to show the oil tank temperature.

Ample washout facilities are provided on the boiler and one Everlasting blow-down valve is fitted on the firebox throat plate and one on the mud collector under the boiler barrel. Alfloc continuous blow-down equipments is fitted.

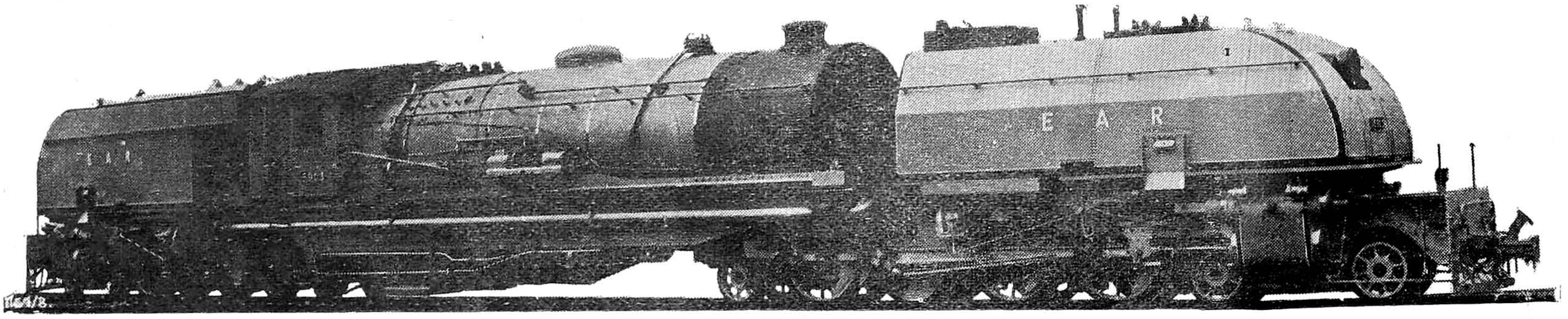
To feed this boiler, two Davies & Metcalfe live steam injectors are fitted on the fireman's side of the boiler, and one on the driver's side, each operated by a quick acting steam valve fitted in front of the cab, the injectors feed into a treble clackbox mounted on the top of the boiler in front of the dome. A steam turret is fitted forward of the cab together with three 3" Ross pop safety valves.

The boiler is lagged with Fibreglass mattresses supplied by Messrs. W. Gilmour-Smith & Co. Ltd.

ENGINE UNIT

The bar frames of the Engine units are $4\frac{1}{2}$" thick, Machined from rolled steel slabs, forming a rigid foundation with the cast steel stretchers.

The cylinders are of cast iron, each pair being bolted together on the engine centre line to form a rigid stay. The cylinders and valve chests have cast iron liners, and the pistons are of cast steel with cast iron peripheries and three narrow rings. Wota N.C. type bypass valves together with anti-vacuum valves are fitted on the cylinders. The cylinder drain cocks are operated by a steam serve cylinder on each unit. The cylinder and main steam pipes are lagged with Fibreglass. Britimp packing supplied by the British Metallic Packing Co. is used on the piston rods. Cast steel crossheads of the Laird type with the arms cast integral are used, the slippers being of cast iron with whitemetal linings.



A Hadfield Precision Power Reverser is used to operate the reversing gear. This patent reverser with fingertip control has proved itself in over 700 applications to give positive selection and to retain the desired cut–off with complete absence of creep. The valve travel is 6 11/16″ and the valve liners are 10″ bore, the Walschaert valve gear being arranged so that the dieblocks for both units are in the lower portion of the link for chimney first running. Case hardened motion pins of adequate size are used in conjunction with bronze bushes to give generous bearing surfaces. The fixed pins are in bushes of hard cued steel. Skefko self-aligning roller bearings are used on the main driving crank pin and for the return crank. The remaining coupling rod bearings are of bronze, whitemetal lined, the bushes being pressed into hard steel bushes fixed in the rod eyes.

To enable the locomotive to negotiate 350 ft. radius curves without gauge widening, the intermediate and driving wheel tyres have thin flanges whilst all the other wheels have normal tyre profiles. It is of interest to note that although the locomotive has been designed for metre gauge, provision is made so that if at a later date the gauge of the railway is altered to 3'-6" then the locomotives can be converted with a minimum of trouble to the new gauge by the fitting of new tyres together with some machining of the wheel centres.

The locomotive is fitted throughout with Timken Roller bearing axleboxes of the cannon type, those of the inner trucks being of a special design to accommodate the bridle bracket and oil baths for the bearing spring shoes and side control spring gear brackets.

The coupled wheel axlebox guides are to a special East African Railway's design, which eliminate the normal adjusting wedges. The faces of the guides and axleboxes are fitted with manganese liners to give long life and reduce wear.

The outer bogie frames are one piece steel castings made by Beyer, Peacock & Co. Laminated springs are used for the suspension and for the side control, in conjunction with two pin swing links.

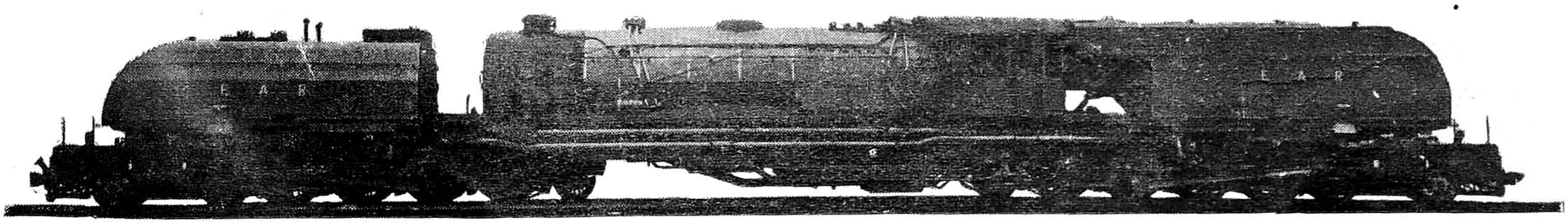
Compensated springing is divided in two groups on each side of the engine units, one group being the outer, intermediate and driving coupled wheel and the other being the inner coupled wheel and inner truck. As mentioned before care has been taken to provide adequate staying of the engine units, cast steel and plate stretchers being used. The pivot centre cast integrally with the frame stretcher is of the patented Beyer, Peacock self-adjusting type, which has been so outstandingly successfull since its inception and has proved to be one of the most important items contributing to the success of the Beyer, Peacock design of the Garratt locomotive.

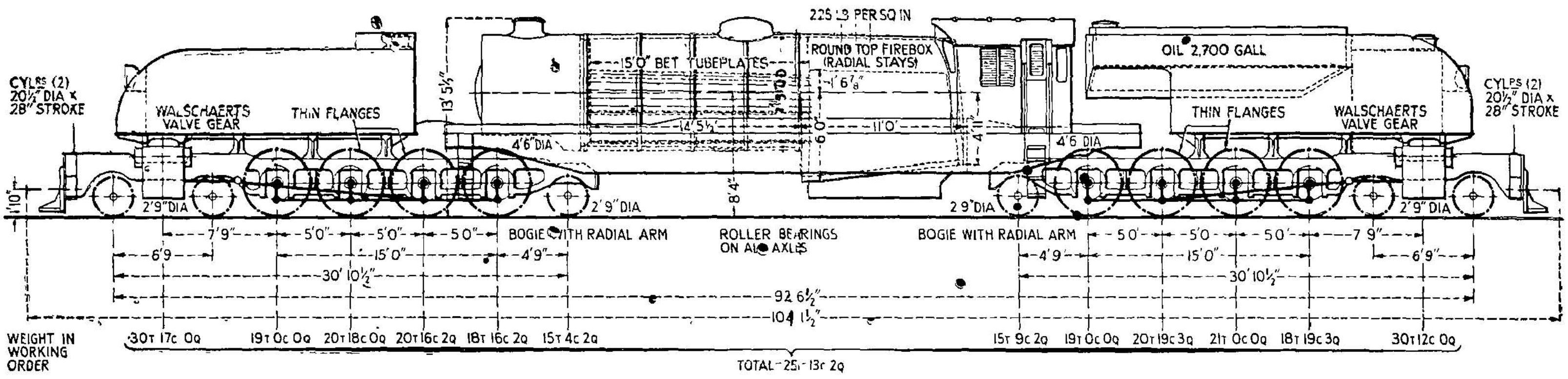
LUBRICATION AND ACCESSORIES

Each engine unit is fitted with a 12 feed Silvertown mechanical lubricator for feeding the piston rod glands, steam and exhaust pipe ball joints, cylinders and valves and on each unit an 8 feed lubricator of the same disign feeds the pivot centres and slide bars. The horn cheeks are syphon-fed from oil boxes as are also the walschaerts gear, connecting and coupling rod bearings, except those on the driving crank where the SKF bearing is grease packed. Ajax soft grease lubrication is used for the brake gear, and for the pins of swing links on the bogie.

The locomotive is fitted with a steam brake on both units, whilst a hand brake is fitted in the cab which controls only the rear unit. For braking of the train a Westinghouse automatic brake is used; twin air compressors being fitted on the left hand side of the smokebox, the steam cylinders of which are lubricated from the cab by a 2 feed Wakefield "AC" type hydrostatic lubricator with a separate condenser, a Gresham & Craven proportional steam brake valve is fitted for use in conjunction with the air brake. Compressed air sanding is provided to the inner and outer coupled wheels of each unit, so that adequate sanding can be provided for running in either direction, this equipment also is supplied by Messrs. Gresham & Craven.

ABC couplers of the M. C. A-P. H. type are fitted in conjunction with Spencer-Moulton rubber draw gear,





provision being made for replacement of this drawgear if required at a later date by the Alliance type of automatic knockle couplers. The small steam pipes between the boiler and engine units are fitted with "Flexstel" flexible joints.

The oil fuel tank is of all-welded construction and is fitted in the space provided in the rear unit's water tank for a coal bunker should the occasion arise to change over from oil fuel. Space has also been left to accommodate a mechanical stoker complete with conveyor through if required at a later date.

The two water tanks are of robust design with riveted joints and are secured to the engine units by the Beyer, Peacock patented method of flexible fastenings. To provide quick levelling in the tanks when high speed filling is used on the Railway, two large bore equilibrium pipes are fitted. In the curved portion at the outer ends of the tanks, provision is made to carry lifting jacks.

CAB AND FOOTPLATE FITTINGS

In the tropics a large cab of ample size with an insulated double roof and plenty of ventilation is a necessity, these cabs conform with these requirements and are provided with comfortable seats upholstered with Dunlopillo for the engine crew. A tip-up seat is provided for the inspector. All the controls come conveniently to hand, the regulator as can be seen, is fitted with a handle on each side of the cab. The oil burning controls are suitably positioned in front of the fireman, and provision is made for presteaming. A Smith's Stone electrical speed indicator is fitted in a convenient position, and two Klinger water gauges of the reflex type, which are marked to show the minimum water level on various gradients, an important consideration on a railway with heavy gradients. Electric lighting is provided in the cab and current is produced by a Turbo-generator, type LBB, supplied by J. Stone & Co. the equipment includes a headlight on the front unit, a back-up light on the rear together with classification lights and the illumination of the value gears, plug points being provided for an inspection light.

The locomotives will be painted on their arrival in Kenya in the railway colours of maroon and black with yellow lining and red bufferbeams, and will be numbered 5901 to 5934 inclusive.

These Beyer-Garratts, descendants of a long line of this type of locomotive, should prove a welcome addition to those already in service in the Colony, being economical and reliable in operation, and low in first cost.

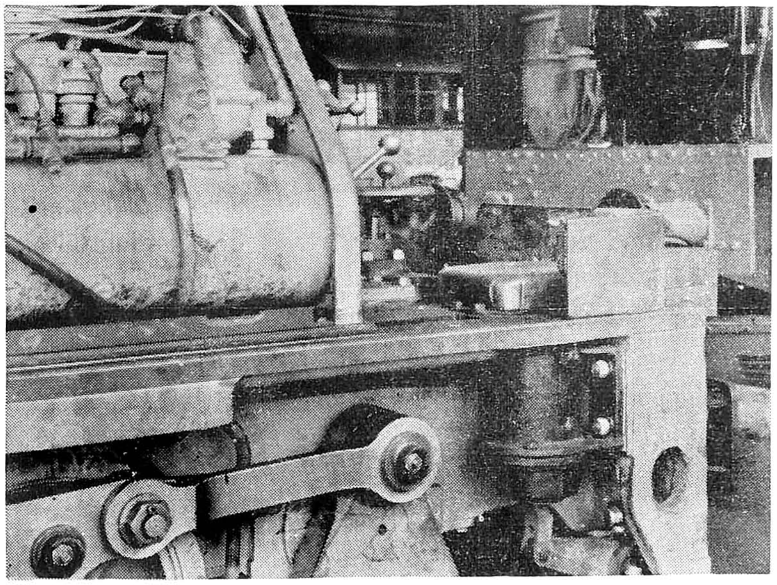
The Principal dimensions are as follows :—

Cylinders (4) dia. by stroke	20½ in. X 28 in.
Coupled wheel dia.	4 ft. 6 in.
Bogie wheel dia.	2 ft. 9 in.
Axleload maximum	21 tons.
Length over buffers	104 ft. 1½ in.
Total weight in working order	252 tons.
Boiler pressure	225 lb. / sq. in.
Heating surface	
Tubes	3,313 sq. ft.
Firebox	247 sq. ft.
Total evaporative	3,560 sq. ft.
Superheater (inside)	747 sq. ft.
Total	4,307 sq. ft.
Grate area	72 sq. ft.
Tractive effort at 85% B.P.	83,350 lb.
Tractive effort at 75% B.P.	73,540 lb.
Oil capacity	2,700 gal.
Water capacity	8,600 gal.

SIMMONDS SELF-LOCKING NUTS

THE use of castle nuts and split pins, locking washers and double nuts for secure assembly, has now been widely superceded in all Industries by the application of various types of self-locking nuts, and these give improved performance at considerably reduced production costs.

Three well-known examples are the Fibre Nut, the Pinnacle Metal Diaphragm Nut and the Nyloc Nut. Manufactured by Simmonds Aerocessories Ltd. of Treforest, Pontypridd, Glamorgan, Gt. Britain, these self-locking nuts are absolutely unaffected by vibration and each has a special purpose in its application.



Diesel Loco. General applications.

FIBRE NUT

The Fibre Nut, designed for general external use where a positive lock is required, is a standard hexagon nut with overall height slightly increased to incorporate a special fibre insert. This insert or collar has an internal diameter slightly less than the diameter of the engaging bolt and is not initially threaded.

In assembly, when a bolt passes through the threaded portion of a Fibre Nut and reaches the fibre insert, further advance is resisted. In overcoming this resistance, the nut is forced away from the bolt head, until the sides of the thread are in close contact.

This force distributes itself as a pressure on the side of the bolt thread which will normally carry the load when the nut is drawn home and the pressure results in heavy friction between the sides of the thread in contact. Thus a considerable anti-rotational force is exerted to prevent the nut from moving under vibration.

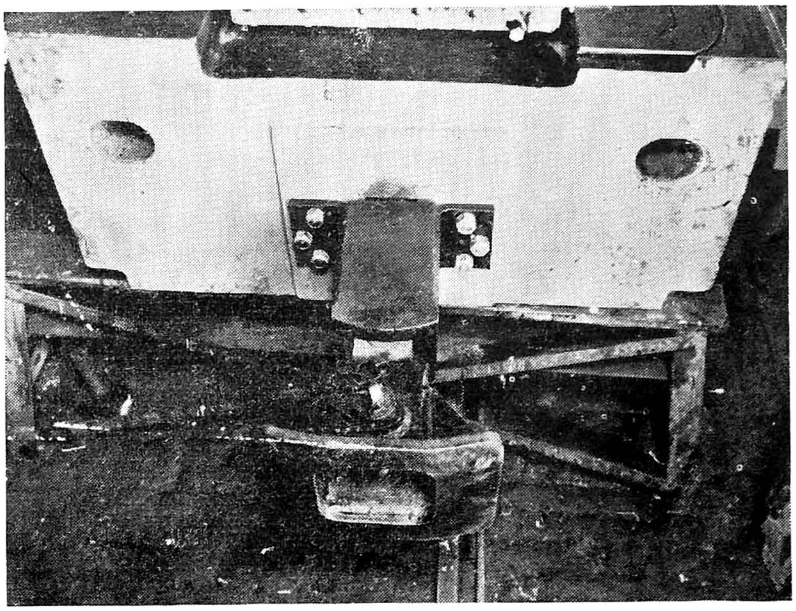
The bolt makes its own thread through the fibre insert and the special elastic properties of the material ensure that no chips are removed when it engages the bolt threads. Pressure between the insert and the bolt further increased the anti-rotational characteristic of the nut.

PINNACLE METAL DIAPHRAGM NUT

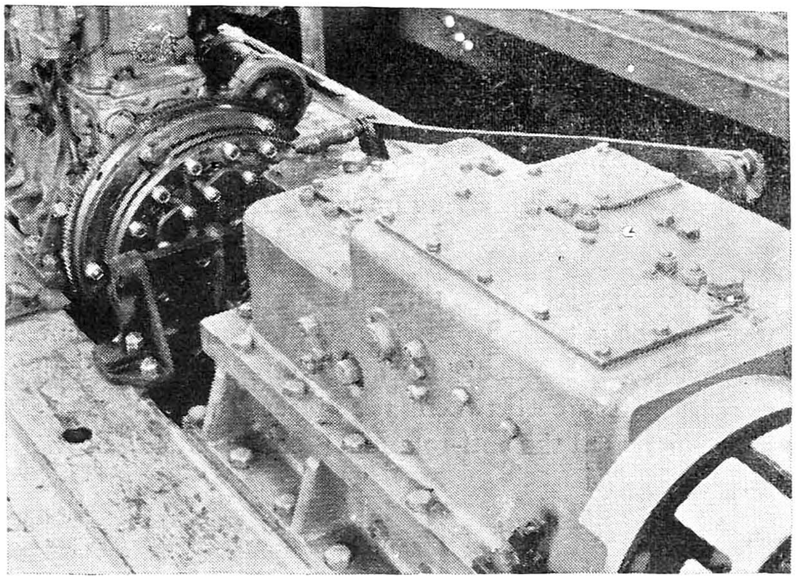
The Pinnacle Metal Diaphragm Nut has been developed for immersion in oils and other fluids and where high temperatures exist. In design, the Pinnacle Nut is also a standard hexagon nut and it incorporates a unique non-corrodible spring steel diaphragm or cap which has an inside diameter equal to the core diameter of the bolt. This diaphragm is depitched and on engaging the bolt thread it is deflected by an amount equal to at least half the pitch of the thread. The resulting self-locking action is similar to that of the Fibre Nut.

NYLOC NUT

Constructional dimensions of the Nyloc Nut are similar to the Fibre Nut and mechanically the self-locking principles function in the same way. A special form of



Locomotive coupling.



Diesel Loco. General applications.

nylon has been introduced to bring about this latest development in stiffnut technique.

Nyloc Nuts give improved performance under extremely critical conditions. Comparisons with all-metal nut endurance characteristics show the Nyloc Nut has several considerably advantages, one being its extraordinary ability to adjust itself to bolt thread irregularities. This significant feature is borne out by results obtained from cold flow tests and these properties of rapid recovery show that the nut is not affected by bolt dimensional limits. The nut possesses good dimensional stability under varying conditions of temperature and humidity extremes and it is also impervious to all oils, boiling water and many chemical solutions.

NYLOC CAP NUTS

Another form of Nyloc Nut is the cap nut. In this instance the self-locking insert and cap are one integral moulding and this affords a completely leak-proof seal which is necessary for special applications such as pressurised chambers of various types, fuel tanks, etc.

SELF-LOCKING CHARACTERISTICS

Before a bolt reaches the insert of the Fibre or the Nyloc Nut, or the metal cap of the Pinnacle Nut, each has every advantages as well as every shortcoming of a standard nut, for the play between the threads is to

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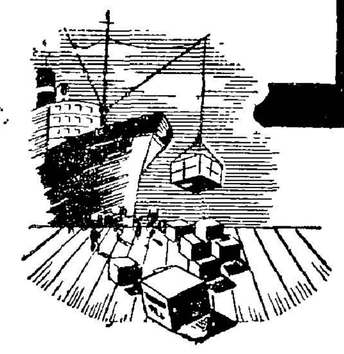
PROVISION OF MORE PASSENGER AMENITIES ANNOUNCED BY RAILWAY MINISTER

Sri Lal Bahadur Shastri, Minister for Railways and Transport announced in a recent broadcast that two vestibuled Janatha Trains in which passengers could walk from one end of the train to the other are expected to be brought into service on the Indian Railways within the next few months. Conductors will be posted on these trains to look after the needs and conveniences of third class passengers. The Railway Minister also declared that dining cars on trains were being re-designed on more utilitarian lines and cheap standard menus to suit tastes of regional people were being evolved.

Amongst the other new schemes the Railways were implementing for the benefit of the passengers, the Railway Minister said that mobile cinema vans were being adopted to exhibit selected documentary films, by rotation at important railway stations throughout the country, in order, as he put it, "to usefully fill the time of passengers waiting for trains, and at the same time to give them a visual idea of what was going on in this great country of ours". It was also proposed to help and guide passengers as to how they could take the fullest advantage of the various amenities which the Railways were now providing. Certain minimum passenger amenities had been laid down for provision at all stations irrespective of their size or status. Electricity and telephones would be provided at every station where these could be conveniently made available. 30,000 fans had been fitted in old coaches, while all the new coaches coming on the line were all being fitted with fans. The Minister said that provision of additional amenities for long distance passengers was under consideration and that an improved type of third class sleeper coach was being designed. He also extended the assurance that passenger amenity works would never be allowed to suffer for lack of funds.

India's Tea- India's Wealth



EXPORT:

During 1954 India exported 450 million pounds of tea. This is more than 2/3 of her total production. Exports were directed to Great Britain, United States, Eire, Canada, Egypt, Continental ports, Turkey, Sudan, Australia, New Zealand, Iran and other countries.

TEA BOARD INDIA

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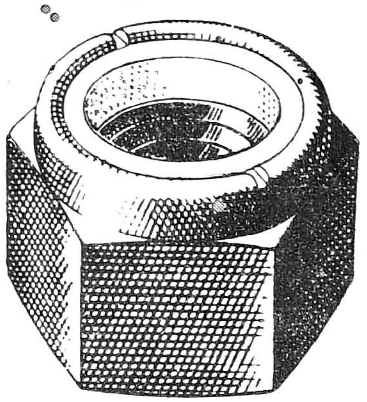
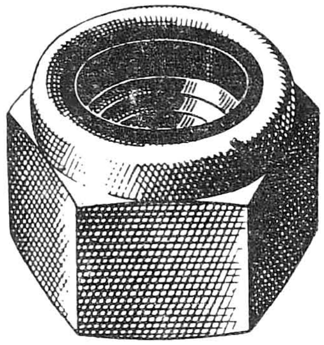
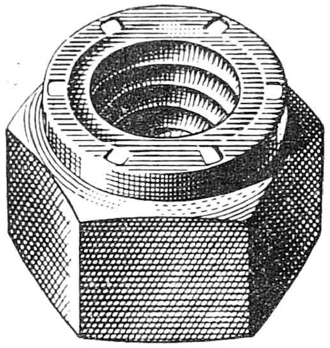
NYLOC



FIBRE



PINNACLE



specified tolerances. This clearance, necessary as it may be for ease of production and assembly, is the main cause of an ordinary nut loosening under vibration.

The metal diaphragm of the Pinnacle is designed so that the strain due to deflection is still within the limit of proportionality of the material. The self-locking characteristics of all three Nuts are effective on bolts manufactured to all recognised standards in use throughout industry.

Simmonds self-locking nuts possess normal tensile and shearing strength. Under test it has been found that the Nyloc can be used many times and still retain its locking efficiency.

The Nyloc range which includes ordinary hexagon nuts, cap nuts, clinch nuts, strip nuts, single, double and floating anchor types has been fully approved for use on aircraft construction and is inter-changeable with, or alternative to, the existing British Aircraft General Standards range of all-metal self-locking nuts.

APPLICATIONS

Fibre, Pinnacle and Nyloc Nuts are now widely used throughout the world in the automobile and aircraft industries and by manufacturers of railway, mining, agricultural and industrial equipment. Wherever problems of vibration and positive fastening are involved, these Nuts may safely be selected for their superior qualities. Their ability to lock in any position on the bolt makes them ideal where positioning is required as on instruments and appliances, etc. "Fibre", "Pinnacle" and "Nyloc" nuts are specified by leading designers who recognise their technical superiority—production and maintenance engineers welcome them because they are simple and reliable to use.

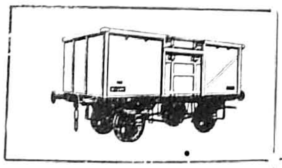
EXPANSION OF CHITTARANJAN LOCOMOTIVE WORKS—FIRST PHASE SANCTIONED

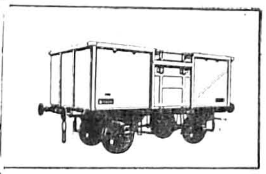
The Government of India have sanctioned the first phase of expansion of the Chittaranjan Locomotive Workshop, whose target of production has now been raised to 200 locomotives per year and more thereafter.

Pending finalisation of the detailed scheme relating to the proposed expansion and expenditure involved therein, the Government of India have decided that certain preliminary works like construction of additional staff quarters, procurement of building and structural materials should be taken in hand. An amount of Rs. 6,88,000 has been sanctioned for the first phase.

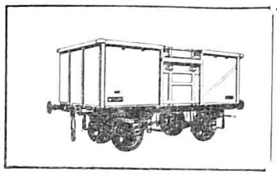
The Chittaranjan Locomotive Workshop was originally designed to produce 120 average size locomotives and 50 spare boilers per year, working on a single shift. This target has already been achieved ahead of time and Chittaranjan is currently producing an average of 10 W. G. locomotives a month.

The Railway Board has given its approval to the working of a second shift at Chittaranjan for implementing the expansion programme.





11,000 ... STRONG



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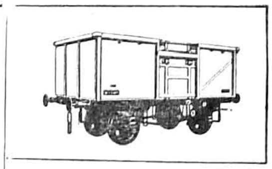

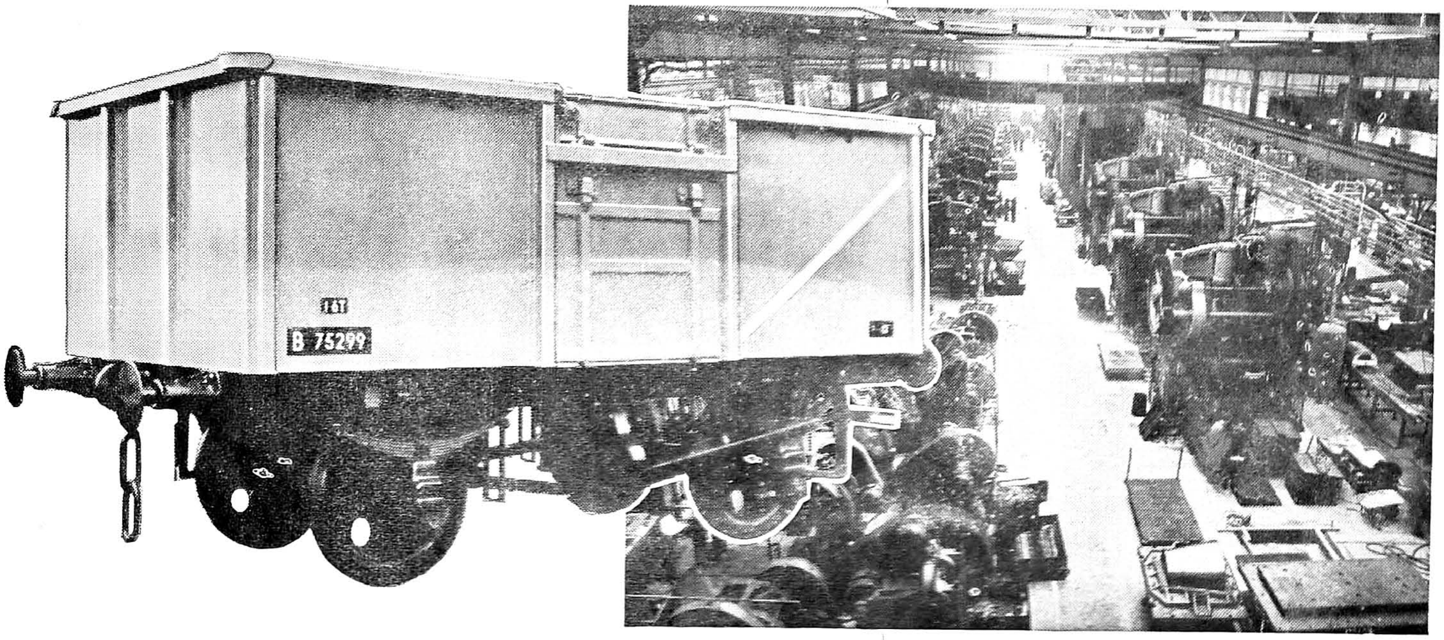

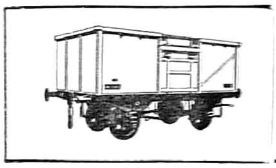

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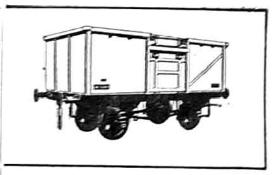

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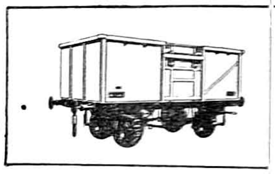

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All Railwaymen should set an example of cleanliness. This will help others and themselves.

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